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Expert View

Why African estuaries matter? An expert perspective on regional and global sustainability

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Abstract

African estuaries are critical ecosystems that serve as vital interfaces between terrestrial and marine environments, playing indispensable roles in regional and global sustainability. Africa possess the second largest river in the world, the Congo river. This review article synthesizes expert perspectives on the multifaceted importance of these dynamic systems, highlighting their ecological, economic, and social contributions. We explore their significance as biodiversity hotspots, nurseries for commercially important species, natural filters for pollutants, and buffers against climate change impacts. Furthermore, the article examines the threats facing African estuaries, including pollution, habitat degradation, overexploitation, and climate change, and discusses the implications for human well-being and ecosystem resilience. Key findings of this review is stated as follows: The total outflow from African rivers into the adjoining seas is estimated at 3,271.4 km^3 per year, representing approximately 8.7% of the global river flow into the oceans; People living on African deltas and estuaries were estimated at approximately 62 million people in 2017, representing about 19% of the total population living in deltas; and the overall economic income value generated by the harbour operations in Dakar, Abidjan, Lagos, Alexandria, Durban, Mombasa, and Maputo is estimated to be 22–37 billions of USD annually. By integrating current research and expert insights, we underscore the urgent need for integrated management strategies and conservation efforts to safeguard these invaluable natural assets for present and future generations.

Key words: African estuaries, biodiversity, climate change, coastal management, conservation, ecosystem services, sustainability

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Introduction

Estuaries, where freshwater from rivers meets and mixes with saltwater from the ocean, are among the most productive and biologically diverse ecosystems on Earth (Manning 2025). In Africa, these transitional zones are particularly crucial, supporting a vast array of flora and fauna, and providing essential services to millions of people (Freeman et al. 2019). The continent's diverse coastline, stretching over 30,000 kilometres, is punctuated by numerous estuaries, ranging from large, well-developed systems fed by major rivers like the Nile, Congo,

and Zambezi, to smaller, more ephemeral systems (Dube et al. 2025). These estuaries are not merely geographical features; they are dynamic ecological engines that underpin regional economies, cultural practices, and environmental stability (Vasconcelos et al. 2024; Carvalho Jr 2025). Understanding "Why African Estuaries Matter?" requires a comprehensive examination of their ecological functions, the socio-economic benefits they provide, and the increasing pressures they face in an era of rapid environmental change and population growth (Booi et al. 2022; Barnes et al. 2026). This article aims to provide an expert perspective on these critical issues, drawing upon the latest scientific understanding and highlighting the imperative for their sustainable management.

Major rivers in African

Africa possesses a vast number of rivers, over 150 rivers, out of which seven major rivers, as follows (Fig. 1): Nile, Congo, Niger, Zambezi, Orange, Limpopo and Ubangi (a tributary Congo) rivers (Dube et al. 2025). Congo river is ranked second-largest river in the world, after the Amazon, with an average annual discharge of approximately 1,293 km^3/year (Olson and Omoyajowo 2025).

The global continental flow of freshwater into the ocean is estimated to be 37,411 ± 7,816 km^3 yr^{-1} (Collins et al. 2024). This figure represents the average and monthly variability of water discharged from rivers into the ocean, based on corrected simulations over a 30-year period (1980–2009). African rivers, while numerous, generally have lower average discharge rates compared to those in South America and Asia, primarily due to climatic factors, including extensive arid and semi-arid regions, and different topographic characteristics that influence runoff (Onyari et al. 2025). The total outflow from African rivers into the adjoining seas is estimated at 3,271.4 km^3 per year, representing approximately 8.7% of the global river flow into the oceans. A significant portion of this discharge, about 71%, originates from rivers in West Africa (Akpoti et al. 2024). The Congo River, the second world largest river, is contributing by about 3.4% of the global freshwater input onto the oceans (Olson and Omoyajowo 2025). Other significant African rivers contributing to estuarine freshwater input include the Nile, Niger, and Zambezi, but their individual contributions are considerably less than the Congo's. Fig. 1 illustrates the principal rivers of Africa and their estimated annual discharge into adjacent seas and oceans, while Table 1 presents the specific discharge data for the major African rivers flowing into the ocean.

Ecological significance

African estuaries are renowned for their exceptional biodiversity, serving as critical habitats for a wide range of species, many of which are endemic or endangered (Niekerk et al. 2020; Barnes et al. 2026). The mixing of fresh and saltwater creates unique environmental conditions that support specialized plant and animal communities, including mangroves, salt marshes, seagrass beds, and diverse invertebrate and fish populations (Ujwala 2025).

Mangrove ecosystems are vital for coastal protection, fisheries support, carbon sequestration, and as a source of livelihood for many coastal communities. African estuaries and deltas contain approximately 3.36 million hectares (Mha) of mangrove forest, which constitutes about 19–20% of the global mangrove

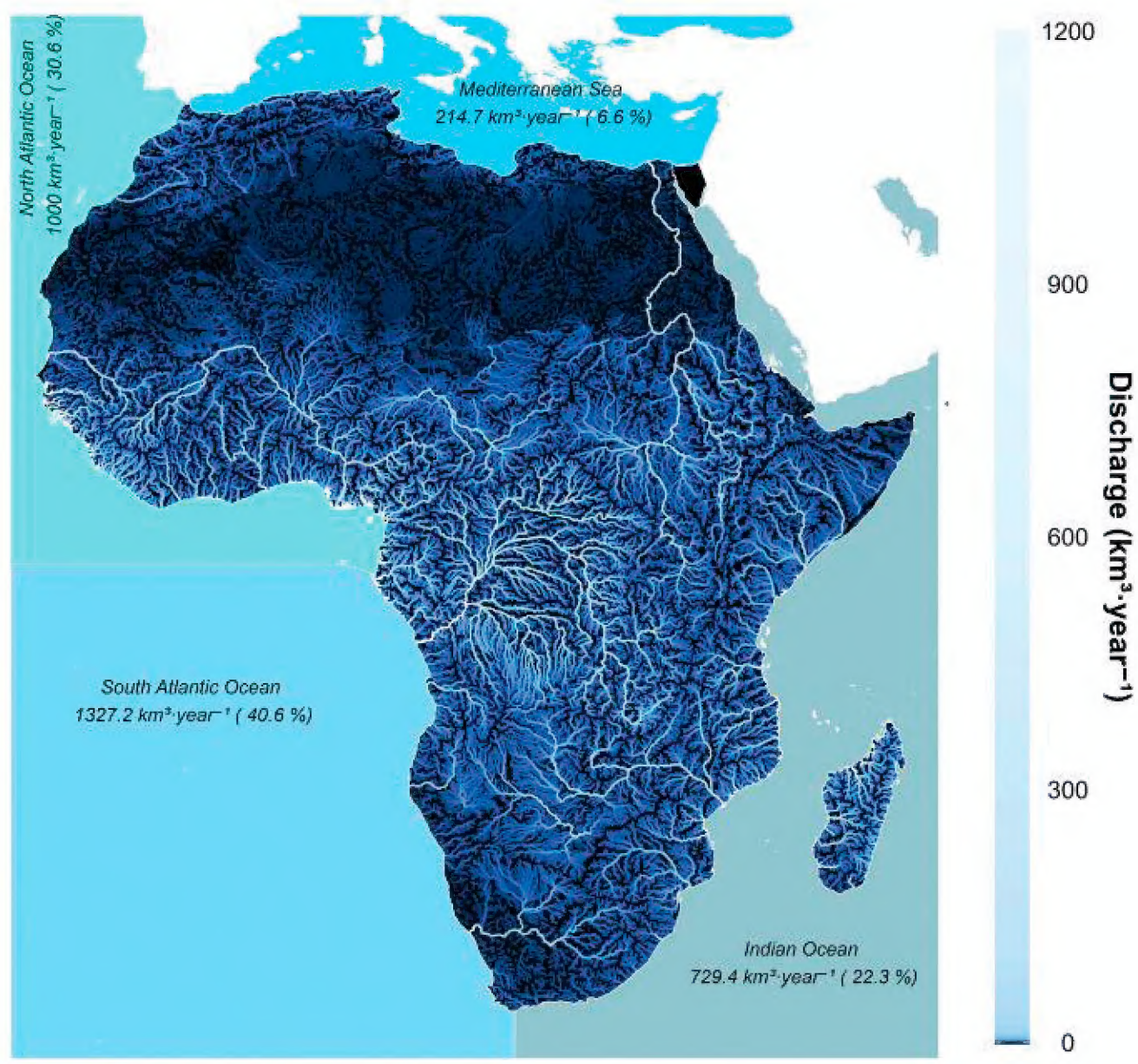

Figure 1. Major river basin of Africa, with estimate of the total average annual discharge from the African continent to the surrounding oceans (Akpoti et al. 2024).

Table 1. Annual average river runoff and the estimated number of people living within the main African deltas and estuaries.

River Basin	Annual Average Runoff (km^3/ year)	References	Estimated Population in the Delta/Estuary (Million)	References
Nile	**84**	Melesse and Demissie (2024)	58 (in 2017)	Blouin (2024)
Congo		Muvundja et al. (2025).	8 (in 2024)	https://mh.maptons.com/1692019; https://mh.maptons.com/559712; https://mh.maptons.com/190400
Niger	**200**	Afolabi (2025)	33 (in 2018)	Nababa et al. (2020).
Zambezi	**106**	Lugomela et al. (2021)	0.452 (in 2017)	https://www.citypopulation.de/en/mozambique/admin/
Orange	**11**	Karamage et al. (2021)	0.015 (in 2023)	https://nsa.org.na/census/kharas-reggion/ https://www.city-facts.com/alexander-bay-northern-cape/population
Limpopo	**6**	Nyikadzino et al. (2020)	0.292 (in 2017)	https://www.citypopulation.de/en/mozambique/admin/
Volta	**43**	Ndehedehe et al. (2017)	0.850 (in 2010)	Codjoe et al. (2020)
Senegal	**22**	Bruckmann et al. (2022)	0.365 (in 2023)	Taïbi et al. (2023)

cover. The global mangrove cover is estimated to be around 17–18 Mha (Digital Earth Africa Global Mangrove Watch, accessed on 6th January 2026 from https://registry.opendata.aws/deafrica-mangrove). West Africa accounts for the largest portion of the continent's mangroves, with the Niger Delta in Nigeria being a particularly extensive mangrove ecosystem (Spalding et al. 2010). East

Africa and Madagascar also possess significant, though often more fragmented, mangrove forests (Dahdouh-Guebas and Koedam 2006).

The estuaries' ecological functions are multifaceted and crucial for both natural systems and human well-being. A more comprehensive and accurate formulation of their main ecological functions includes: Biodiversity Hotspots, Nursery Grounds, Water Quality Regulation, Carbon Sequestration, Coastal Protection, and Nutrient Cycling.

Biodiversity hotspots

These ecosystems are often referred to as biodiversity hotspots due to the high concentration of species they support (Fortune et al. 2023; Wang and Kurata 2024). For instance, mangrove forests, a characteristic feature of many African estuaries, provide crucial breeding grounds and nurseries for numerous fish, crustacean, and bird species (Pimentel et al. 2023). The East African mangroves are particularly diverse, hosting a significant proportion of the world's mangrove species (Naidoo 2023).

Nursery grounds

Estuaries act as vital nursery grounds for a multitude of marine species, including many commercially important fish and shellfish (Lewis et al. 2020; Rakib et al. 2022). Juvenile fish and crustaceans find refuge and abundant food resources in the sheltered, nutrient-rich waters of estuaries, increasing their survival rates before migrating to the open ocean (Dutton et al. 2019; Groeneveld et al. 2021). This function is critical for maintaining healthy fish stocks and supporting coastal fisheries (Sheaves and Johnston 2009).

Water quality regulation

Estuarine ecosystems, particularly wetlands and mangroves, play a crucial role in filtering pollutants and excess nutrients from terrestrial runoff before they reach the marine environment (Nataniel et al. 2022; Rasmussen et al. 2024). This natural purification process helps to maintain water quality, protect coral reefs, and support other sensitive marine habitats (Carlson et al. 2021). The mangrove forests of the Rufiji Delta in Tanzania are an excellent example of this ecosystem service, trapping sediments and absorbing pollutants (Monga et al. 2022; Ntibona et al. 2022).

Carbon sequestration

Coastal wetlands within estuaries, such as mangroves and salt marshes, are highly effective at sequestering atmospheric carbon dioxide, making them significant "blue carbon" ecosystems (Choudhary et al. 2024; Sadat-Noori et al. 2025). They store large amounts of carbon in their biomass and sediments, contributing to climate change mitigation efforts (Choudhary et al. 2024; Gomis et al. 2025). The mangrove ecosystems along the West African coast are estimated to store substantial quantities of carbon, with an estimated total stock of 854 million metric tons of carbon across

approximately 1.97 million hectares (Bryan et al. 2020). These stocks vary by location and forest structure, with an average ecosystem carbon density of approximately 799 Mg C ha^{-1} in the West-Central Africa region (Kauffman and Bhomia 2017).

Coastal protection

Estuaries, with their associated wetlands and vegetation, act as natural buffers against coastal erosion, storm surges, and tsunamis (Gedan et al. 2011; Rowland et al. 2025). The dense root systems of mangroves and salt marsh grasses stabilize sediments, reduce wave energy, and protect coastal communities and infrastructure from the impacts of extreme weather events (Jayson-Quashigah et al. 2025; Justine et al. 2025). The mangrove belts in Mozambique have been shown to significantly reduce the impact of cyclones (Macamo et al. 2016; Foggia et al. 2025).

Socio-economic importance

Beyond their ecological value, African estuaries provide a wide array of socio-economic benefits that are fundamental to the livelihoods and well-being of millions of people. They host a variety of cities and support significant economic infrastructure due to their rich biodiversity and the numerous ecosystem services they provide. These coastal areas are often centres of human activity, leading to both development and environmental challenges (Mumuni 2025). Some of the major cities in estuaries in Africa include Durban and Cape Town, in South Africa, which are prominent coastal cities with significant economic infrastructure that interact with estuarine systems. Beyond South Africa, other African cities which are also intrinsically linked to estuarine and coastal environments are Dakar in Senegal, Maputo in Mozambique, Lagos in Nigeria, Accra in Ghana's. These cities demonstrate the critical role estuaries play in supporting large urban populations and their economies, while also highlighting the vulnerabilities they face from environmental degradation and climate change.

In 2017, approximately 62 million people lived on African deltas, representing about 19% of the total population living in deltas (Edmonds et al. 2020), where Nile and Niger deltas host the majority of population (Table 1).

The economic contribution of estuaries in South Africa is significant, with an estimated annual generation of R4.2 billion, which translates to approximately US$250 million to US$300 million annually (Turpie and Letley 2019). This valuation, based on 2019 data, underscores the substantial financial impact of these ecosystems. For comparison, the total economic value of provisioning ecosystem services provided by the mangrove sanctuary in the Rufiji Delta, Tanzania, was estimated at US$15,911.39 per household per year in 2025 (Mohamed 2025). In another example, the economic value of mangroves specifically within the Mngazana estuary in South Africa ranged between R1.1 million (US$69,636.60) and R13.6 million (US$860,961.60) (Booi et al. 2022).

The primary economic activities within African estuaries are diverse and include, but are not limited to, the following:

Fisheries and aquaculture

Estuaries are the backbone of many coastal fisheries, providing direct sustenance and income for local communities. The abundance of fish, crabs, shrimp, and other seafood supports artisanal and commercial fishing activities. Furthermore, the sheltered waters and nutrient availability make estuaries ideal locations for aquaculture, contributing to food security and economic development. The estuaries of Ghana are vital for their artisanal fishing communities (Kutir et al. 2024).

The estimated annual harvest value of estuarine and mangrove ecosystem-based shellfisheries by women harvesters in West Africa is USD 336 million (Adite et al. 2022). This value is derived from an estimated annual harvest volume of over 300,000 metric tons (MT). It should be noted that women are the predominant resource users in West African estuarine and mangrove ecosystem-based shellfisheries, comprising 79% of harvesters regionally and holding significant roles across the value chain, particularly for bivalves and gastropods (Adite et al. 2022). This sector supports approximately 571,935 household beneficiaries and involves over 50,000 harvesters across 11 West African countries, with an estimated annual shellfish harvest exceeding 300,000 metric tons valued at USD 336 million (Adite et al. 2022).

Tourism and recreation

The scenic beauty and rich biodiversity of African estuaries attract tourists, supporting ecotourism, birdwatching, and recreational fishing. These activities generate revenue, create employment opportunities, and contribute to local economies (Butler et al. 2020; Olisah and Adams 2021). For instance, the Gambia River estuary is a vital area for ecotourism, particularly birdwatching, attracting international visitors and supporting local communities through guiding services, accommodation, and craft sales (Jones 2005). Similarly, the Rufiji Delta in Tanzania, encompassing a vast estuarine system, is crucial for wildlife tourism, especially photographic safaris and fishing, contributing to the revenue of national parks and local enterprises (Mohamed 2025). In South Africa, estuaries like the Knysna Estuary are major tourist attractions, generating revenue through water sports, oyster farming tours, and general coastal recreation (Crookes 2023). The economic valuation of these services often includes direct spending by tourists, indirect benefits through supply chains, and induced benefits from increased household income. A study on the economic value of ecosystem services in the Mngazana Estuary, South Africa, estimated significant contributions from tourism and recreation, underscoring the financial importance of these natural assets (Booi et al. 2022).

Transportation and trade

Many major African cities and ports, such as, Dakar, Abidjan, Lagos, Alexandria, Durban, Mombasa, and Maputo are located on or near estuaries, serve as crucial waterways for transportation and trade (Olukoju 2020). The navigability of these systems facilitates the movement of goods and people, connecting inland regions to global markets.

The overall economic income value generated by the harbour operations in Dakar, Abidjan, Lagos, Alexandria, Durban, Mombasa, and Maputo is estimated to be 22–37 billions of USD annually. This figure encompasses direct revenues from port activities, such as cargo handling, storage, pilotage, and tug services, as well as the broader economic impact through logistics, trade facilitation, and associated industries. While precise, consolidated figures are not publicly available for all ports, individual studies and reports highlight substantial contributions to their respective national economies, as indicated in Table 2.

Table 2. Economic income value generated by the harbour operations in Dakar, Abidjan, Lagos, Alexandria, Durban, Mombasa, and Maputo.

Port City	Estimated Annual Economic Income (USD Billions)	Key Economic Drivers	References
Dakar	1.5–3.0	Container traffic, fishing, regional trade hub	Sahoo et al. (2025)
Abidjan	2.0–4.0	Cocoa exports, regional transshipment, industrial activity	Essoh (2013)
Lagos	5.0–8.0	Oil & gas, general cargo, largest economy in West Africa	Osadume and University 2020
Alexandria	3.0–5.0	Suez Canal proximity, agricultural exports, industrial imports	Elhussieny et al. (2024)
Durban	7.0–10.0	Largest port in Southern Africa, automotive, mining, manufacturing	Joynt (2024)
Mombasa	2.5–4.5	East African trade gateway, tourism, agricultural exports	Ogara et al. (2025)
Maputo	1.0–2.5	Coal exports, regional logistics, agricultural products	Campbell and Hauptfleisch (2012)

Cultural heritage

Estuaries often hold deep cultural significance for local communities, being integral to traditional practices, spiritual beliefs, and historical narratives (Amanze 2024; Olaopa 2025). They are sites of traditional resource management, knowledge transfer, and cultural identity. The fishing communities along the Rufiji Delta have a rich cultural heritage tied to the estuarine environment (Shaghude 2016; Ntibona et al. 2022).

Threats and challenges

Despite their immense value, African estuaries are facing unprecedented threats from a combination of anthropogenic pressures and climate change impacts (van Niekerk et al. 2022). The main threats and challenges to African estuaries are Pollution, Habitat Degradation and Loss, Overexploitation of Resources and Climate Change Impacts, described below.

Pollution

Industrial, agricultural, and domestic pollution poses a significant threat to estuarine health (Olisah and Adams 2021). Runoff containing pesticides, fertilizers, heavy metals, and untreated sewage degrades water quality, harms aquatic life, and can lead to eutrophication and oxygen depletion (Sidondi et al. 2025). The estuaries of the Nile Delta are particularly affected by agricultural runoff and industrial discharge (Shetaia et al. 2025). A study by Fourie et al. (2025) investigating pollutant contaminants in the Knysna Estuary, South Africa, revealed significant contamination with potentially toxic elements. Specifically, chromium concentrations

ranged from 0.0021 to 0.0084 mg/kg in water and 150.79 to 1589.63 mg/kg in water sediments, while nickel concentrations were found to be between 0.0041 and 0.0327 mg/kg in water and 63.75 to 740.05 mg/kg in water sediments. The study by Olisah et al. (2021) investigating persistent organic pollutants (POPs) in South African estuaries from 1960 to 2020 revealed concerning levels of contamination, with concentrations exceeding health advisory levels for drinking water. Specifically, the Buffalo River exhibited polychlorinated biphenyls (PCBs) concentrations ranging from 85 to 2329 ng/L, hexachlorocyclohexanes (HCHs) from 255 to 650 ng/L, dichlorodiphenyltrichloroethanes (DDTs) from 34 to 36 ng/L, and total organochlorine pesticides (∑OCPs) from 684 to 3637 ng/L. The Swartkops estuary also showed significant PCB contamination, with levels between 14.8 and 2915.6 ng/L. These findings highlight a substantial environmental and potential public health risk in these regions. Further, the study by Faseyi et al. (2022) investigated pollutant contaminants, specifically microplastic particles, in the sediments of two estuaries in the South-western region of Ghana: Pra and Ankobra. Their findings revealed distinct mean concentrations of various microplastic particle types in each estuary. In the Pra estuary, the mean concentrations of microplastic particles were recorded as follows: fibre at 14.22 ± 4.99 particles, sheet at 24.44 ± 13.21 particles, fragment at 38.00 ± 25.47 particles, and bead at 4.22 ± 4.84 particles. Conversely, in the Ankobra estuary, the mean concentrations were observed to be: fibre at 13.00 ± 7.56 particles, sheet at 20.60 ± 12.59 particles, fragment at 8.70 ± 11.22 particles, and bead at 3.30 ± 4.14 particles. These results indicate a higher prevalence of fragment microplastics in the Pra estuary compared to Ankobra, while sheet microplastics also showed higher concentrations in Pra.

Habitat degradation and loss

Coastal development, urbanization, and infrastructure projects often lead to the destruction and degradation of critical estuarine habitats such as mangroves, salt marshes, and seagrass beds (Fendoung et al. 2025). Dredging, land reclamation, and dam construction alter natural hydrological regimes, impacting sediment flow and freshwater input, which are vital for estuarine function (Lubke et al. 2016). The mangrove forests of the Niger Delta have experienced significant degradation due to oil exploration and exploitation (Onyena and Sam 2020). The historical loss of mangroves on a worldwide scale is estimated to be approximately 35–50% of their current area (Giri et al. 2011). More recent data, specifically for the 24-year period between 1996 and 2020, indicates a global loss of 5245 km^2, which represents 3.4% of the total mangrove area (Bunting et al. 2018). Mangrove deforestation in Africa remains a significant environmental concern, with varying rates across different regions and countries. While some areas have shown a slowdown in deforestation due to concerted conservation efforts, others continue to experience rapid decline. The average annual deforestation rate for mangroves in Africa has been estimated to be around 0.2% to 0.5% in recent years, though localized rates can be much higher, exceeding 1% in certain hotspots (Giri et al. 2011; Bunting et al. 2018). For instance, countries such as Nigeria (0.13% to 0.17%), Madagascar (0.2% to 0.4%), and Ghana (1.7% to 2.0%) have historically faced some of the highest rates of mangrove loss (Spalding et al. 2010). The total loss for Africa for a specific period was 152.2 km^2, representing 2.15% of its mangrove cover (Bunting et al. 2018).

Overexploitation of resources

Unsustainable fishing practices, including overfishing and the use of destructive gear, can deplete fish stocks and disrupt estuarine food webs (Wallner-Hahn et al. 2016; Bi et al. 2023). The unregulated harvesting of other estuarine resources, such as timber from mangroves, further exacerbates habitat degradation. For instance, studies in West African estuaries, such as those in Ghana and Nigeria, have reported declines in fish catches ranging from 30% to over 70% for certain commercially important species over the past few decades (Macedo et al. 2025). The Niger Delta, a critical biodiversity hotspot, has experienced significant reductions in fish populations attributed to habitat degradation from oil exploration and exploitation, pollution, and overfishing. Some reports suggest a decline in fish landings by as much as 50% in some parts of the delta since the 1980s (Irabor et al. 2024). Similarly, East African deltas, like the Rufiji Delta in Tanzania, have shown evidence of declining fish stocks, with some studies indicating a decrease in average fish size and a shift towards smaller, faster-reproducing species, indicative of fishing pressure (Mocuba et al. 2024). The Zambezi Delta, while less extensively studied in terms of quantitative fish stock decline, faces similar pressures from upstream damming, altered flow regimes, and increased fishing effort, which are known to negatively impact fish populations (Hoguane and Armando 2015). The overall trend is often characterized by a decrease in the abundance of larger, commercially valuable species and an increase in smaller, less desirable species, a phenomenon known as “fishing down the food web” (Whitfield and Cowley 2010).

Climate change impacts

African estuaries are highly vulnerable to the impacts of climate change, including sea-level rise, increased frequency and intensity of extreme weather events, and changes in precipitation patterns (James et al. 2013). Sea-level rise can lead to inundation of low-lying estuarine habitats, saltwater intrusion into freshwater sources, and increased erosion (van Niekerk et al. 2022). Changes in river flow due to altered rainfall patterns can disrupt the delicate balance of freshwater and saltwater, affecting estuarine productivity (Gillanders and Kingsford 2002). The estuaries along the West African coast are particularly susceptible to sea-level rise (Dada et al. 2024). van Niekerk et al. (2022) identified key Climate Change stressors considered relevant to South African estuaries and their projected impacts on these vulnerable ecosystems, as follows:

- Land climatic/hydrological processes forcing changes in freshwater inflow and associated inputs; shifts in land-sea and longshore connectivity; modifications in salinity regimes; changes in biochemical inputs; changes in sediment deposition/erosion cycles.
- Ocean circulation patterns resulting in shifts in temperature regimes and alongshore coastal connectivity;
- Sea level rise and related impact on salinity regime, mouth state, and inundation of estuarine flood plain;
- An increase in the frequency and intensity of coastal storms impacting salinity regimes and mouth state;

- Ocean acidification amplifying existing pH fluctuations and impacting oceanic phases of estuarine species.

Conclusion and recommendations

African estuaries are undeniably critical for regional and global sustainability, providing an unparalleled suite of ecosystem services that support biodiversity, human livelihoods, and climate resilience. Their ecological functions as biodiversity hotspots, nursery grounds, natural filters, and carbon sinks are indispensable. Economically, they underpin fisheries, tourism, and trade, while culturally, they are integral to the identity of countless communities.

The main findings of this review concerning African rivers, deltas, and coastal economies can be more effectively formulated as follows: African rivers contribute significantly to global oceanic inflow, with an estimated total outflow of 3,271.4 km^3 per year into adjoining seas, which accounts for approximately 8.7% of the global river flow into the oceans. Furthermore, African deltas and estuaries are densely populated, with an estimated 62 million people residing in these areas in 2017, representing about 19% of the total global population living in deltas. Economically, the operations of key harbours in Dakar, Abidjan, Lagos, Alexandria, Durban, Mombasa, and Maputo generate a substantial annual income, estimated to be between 22 and 37 billion USD.

African estuaries, despite their significant socioeconomic and ecological value, face severe threats from pollution, habitat destruction, overexploitation, and the escalating impacts of climate change. The degradation of these vital ecosystems has profound implications for regional food security, economic stability, and the well-being of coastal populations.

To safeguard these invaluable natural assets, a concerted and integrated approach to management and conservation is urgently required. Key recommendations include:

- **Integrated Coastal Zone Management (ICZM)**: Implementing comprehensive ICZM plans that consider the interconnectedness of terrestrial, estuarine, and marine environments is crucial. This involves cross-sectoral collaboration, stakeholder engagement, and policy coherence to address multiple pressures simultaneously.
- **Pollution control and waste management**: Strict regulations on industrial and agricultural discharges, coupled with improved urban waste management and wastewater treatment, are essential to reduce pollution loads entering estuaries.
- **Habitat restoration and protection**: Prioritizing the protection of intact estuarine habitats and undertaking large-scale restoration efforts for degraded areas, particularly mangroves and salt marshes, can enhance ecosystem resilience and services.
- **Sustainable resource management**: Promoting sustainable fishing practices, regulating resource extraction, and empowering local communities in co-management initiatives can ensure the long-term viability of estuarine resources.
- **Climate change adaptation and mitigation**: Developing and implementing adaptation strategies to cope with sea-level rise and extreme weather

events, alongside enhancing the carbon sequestration capacity of estuarine ecosystems, is vital.
- **Research and monitoring**: Continued investment in scientific research and long-term monitoring programs is necessary to better understand estuarine dynamics, assess the impacts of threats, and inform effective management decisions.
- **Capacity building and awareness**: Strengthening the capacity of local communities and government agencies in estuarine management and raising public awareness about the importance of these ecosystems are fundamental for fostering stewardship.

By recognizing the profound importance of African estuaries and committing to their sustainable management, we can ensure that these dynamic and productive ecosystems continue to provide their invaluable services for the benefit of both nature and humanity, contributing significantly to regional and global sustainability.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Use of AI

No use of AI was reported.

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Author contributions

Antonio Mubango Hoguane: Provided a substantial contribution to the conception of the work, analysis; and drafted the manuscript. Cesar Antonio Mubango Hoguane: Contributed in the analysis and reviewed critically the manuscript for accuracy and integrity.

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Data availability

All of the data that support the findings of this study are available in the main text.

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